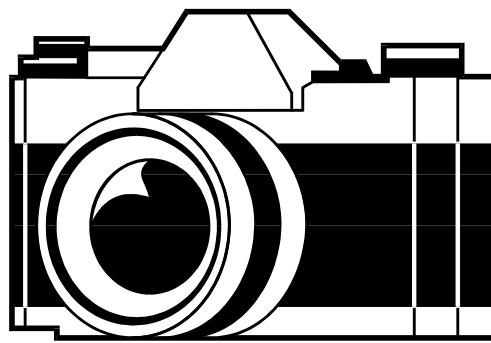
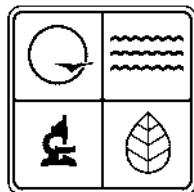


Preventing Pollution in Photo Processing



***A Guide to Environmental Compliance and
Pollution Prevention for Photo Processors in Missouri***



Missouri Department of Natural Resources
Environmental Assistance Office
1-800-361-4827

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The information in this publication is intended as general guidance only. For specific requirements, the reader should consult the appropriate federal and state laws and rules.

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Preventing Pollution in Photo Processing

As environmental protection becomes more and more important across the nation, industries of every type are faced with some big questions –

- What environmental regulations apply to me and my facility?
- How do I comply with those regulations?
- Are there things I can do to reduce the regulations I must meet?
- How can I protect myself from fines and liability?
- How do I protect myself and my workers from environmental hazards in the shop?

This publication can help photo processors in Missouri answer some of those questions. The guides provide basic information about regulatory requirements and suggestions for protecting employers, employees and the environment through pollution prevention.

Each guide sheet in this publication deals with an issue that photo processing businesses may face. The guides will not answer every question, but after reviewing them, a reader should be able to decide if more information or assistance on a particular issue is needed. The topics are listed on the back of this page.

The Missouri Department of Natural Resources has an Environmental Assistance Office (EAO) to help people comply with environmental regulations and find ways to prevent pollution. Those needing assistance can call EAO at 1-800-361-4827.

Additional information can be found at the Silver Council's Web site:
www.silverbureau.org/html/default.htm.

Guide Sheets for the Photo Processing Industry

Pollution Prevention
Aerosol Cans
Backflow Prevention
Batteries
Bleach Solution
Developer
Energy
Film and Paper
Fixer
Floor Cleaning
Fluorescent Bulbs
Hazardous Waste
Hazardous Waste Management
Plastic Film Containers
Shop Towels
Silver Recovery
Solvents
Solvent Disposal
Spills
Storm Water Permits – Land Disturbance
Wastewater
Water Conservation

Those with comments or suggestions on ways to improve these guide sheets can call EAO at 1-800-361-4827.

For More Information

Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176
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www.dnr.mo.gov/oac/env_assistance.htm



Pollution Prevention

Photo processing facilities deal with many things that can affect the environment. Materials such as developer, fixer and even film can harm the environment and people if they are not properly managed. State and federal environmental regulations explain what legally can and cannot be done with these materials. The regulations describe how pollution (waste) should be controlled, stored, treated or disposed of. But a better solution is to prevent the waste or pollution.

What is Pollution Prevention?

Pollution prevention is simply not making the waste (or pollutant) in the first place. It means doing what we can to reduce the amount and toxicity of the pollution we generate. Preventing pollution may be something as simple as using a catch basin to prevent spills, or something as complex as redesigning how your facility is operated to increase efficiency and reduce waste. Simple things like choosing non-hazardous solvents can protect the environment and reduce the number of environmental regulations that apply to a facility. Pollution prevention means thinking about the environmental impact of your actions, and trying to limit that impact.

Why Prevent Pollution?

When waste or pollution is generated, it must be safely and legally managed. Whether it is household trash or waste from a business, managing wastes costs money. And usually the discarded items are materials that have been paid for. A good example is paper towels. They are bought, used once and disposed of at an additional cost. Reducing the amount of waste generated reduces costs. Reducing costs is a major reason to prevent pollution. Here are a few others:

- Improved work environment and worker safety.
- Reduced liability.
- Increased efficiency.
- Fewer regulatory requirements.
- Better environmental protection.
- Enhanced marketing and public relations opportunities.

What Can Be Done At Photo Processing Facilities?

There are many ways to prevent pollution at photo processing facilities. Each of these guide sheets has suggestions on ways to prevent pollution. Here are a few general tips:

- Keep work areas clean and well organized to help prevent accidents.
- Use drip pans and splash guards where spills frequently occur.
- Fix leaks immediately.

- Don't buy more than is needed. The leftovers may become waste.
- Purchase the largest practical container (containers usually end up as waste), but don't purchase more than is needed.
- Purchase the least toxic or hazardous product available. Check products' material safety data sheets. If the product is toxic or hazardous, ask the supplier for alternatives.
- Use the oldest items first (first-in, first-out).
- See if the supplier can take back excess or unneeded materials.
- Include the cost of disposal when making purchasing decisions. What looks like the cheapest option may cost more because of disposal or other management costs.
- Store materials in a way that keeps them from being damaged.
- Inspect storage areas regularly for leaks.
- Make sure all items are clearly labeled. Store products in original containers.
- Store wastes separately and be sure they are properly labeled to make it easier to reuse or recycle them.
- Store items that could leak in a place where leaks will be contained and easily spotted.
- Make a list of wastes. Then try to find a way to eliminate each of them. For example, consider using launderable shop rags instead of throw away paper towels.
- Use squeegees to minimize chemical carryover into rinse tanks. Clean and maintain squeegees as part of regular maintenance and shutdown procedures.
- Reuse fixer and regenerate fixer, developer and bleach.
- Use floating covers on solution tanks.
- Recycle cartridges, cassettes and photographic paper spools to the film manufacturer.
- Be sure employees are trained to mix processing solutions correctly. Improperly mixed chemicals can lead to unnecessary waste generation.
- Establish a maintenance schedule for each piece of equipment.
- Consider using low replenishment options for fixer, developer and bleach.
- Limit access to chemicals.

Additional suggestions can be found at the Silver Council's Web site:
www.silvercouncil.org/html/default.htm.

For More Information

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Aerosol Cans

Photo processors use aerosol cans for various reasons. Spray cans may contain hazardous chemicals, such as 1,1,1-trichloroethane or toluene. In some cases, the aerosol may be hazardous waste because of what it contains or once contained. It is important to carefully manage this waste to protect human health and the environment.

Aerosol cans are often recycled as scrap metal. If the empty cans are recycled, the can and the residue inside are not considered waste so most hazardous waste regulations do not apply. If the can is not empty, it can still be recycled if the recycler is able to properly capture and manage the remaining contents. However, if the aerosol can contained an acutely hazardous waste such as some pesticides, it is unlikely that the recycler will be able to properly clean the container. These containers will probably require disposal. See the *Hazardous Waste* guide sheet for more information on acutely hazardous waste.

Empty aerosol cans can be recycled or sent to a sanitary landfill for disposal.

Conditionally exempt hazardous waste generators can occasionally send one or two waste aerosol cans to a sanitary landfill for disposal (even if they are not empty), if the landfill is willing to accept them. Landfill approval is especially needed if a can contains pesticide. Those who generate more than two cans must find out whether the waste is hazardous and manage it properly. See the *Hazardous Waste* guide sheet for more information.

Ask the supplier to take back any defective cans. The manufacturer can sometimes repackage the materials.

Remember

- Aerosol cans may be hazardous waste. Find out whether the waste is hazardous and manage it properly.
- Empty cans, and sometimes cans that are not empty, can be recycled. Sometimes the contents can be reused.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of waste can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Determine actual needs. If a product is not needed, use up what is in stock and do not purchase any more. If a product is needed, limit its use and look for aerosol cans that do not contain hazardous chemicals.
- ✓ Switch to non-aerosol products if possible, such as manual pump cans or bottles, especially if they can be refilled.

- ✓ Use as much of the material as possible, for its intended purpose rather than discarding useable material.
- ✓ Purchase only the amount needed.
- ✓ Follow label directions to prevent clogging.
- ✓ If aerosol cans contain hazardous materials, look for non-hazardous alternatives.

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Backflow Prevention

Whether a business uses water from the public water supply or has a private water supply, such as its own well, it is important that it avoid contaminating that water. In some situations, water (and any contaminants it comes into contact with) can flow backwards in a water line. This can contaminate the water in a building and even the entire water supply. Backflow prevention devices prevent this problem.

In places where the water line comes into direct contact with a potential contaminant, the contaminant can travel back into the water line when there is a change in pressure. This is called a cross-connection. For example, if process water from a film developing area flowed back into a water system, the entire facility's water system could be contaminated with photo chemicals.

Backflow prevention devices or assemblies are installed in water lines to keep this from happening. They are placed in water lines entering the building and at points in the water system where it connects to a potential source of contamination.

State regulations require that businesses connected to a public water supply protect the public water supply from cross-connections within their premises. If a business' operation could cause contamination to the water supply, it must have backflow prevention.

Drinking water regulations require that the backflow prevention assembly be placed on the water service line. It is a good idea to put additional backflow preventers at any location in a business where contamination could occur.

The local water supplier may have additional requirements regarding backflow prevention. Contact that office to find out.

Even businesses not connected to a public water supply should install backflow prevention devices to protect the business, its employees and its customers from the risk of contaminated drinking water and to prevent pollution.

The Department of Natural Resources maintains a list of approved backflow prevention assemblies. To get a copy, call the Environmental Assistance Office at 1-800-361-4827.

Remember

- Preventing backflow into the water system protects the business and anyone using its water supply.
- Businesses connected to a public water supply system may be required to have backflow prevention assemblies or devices.

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Batteries

Batteries are found in many of the electronic devices used by businesses. All of these batteries must eventually be disposed of, and some batteries are hazardous waste upon disposal. Batteries that are hazardous can usually be handled as universal waste.

Common Battery Types

The **zinc carbon** battery is labeled as "all purpose" or "general purpose" and discharges quickly if used continuously. The zinc chloride cells are longer lasting and are labeled "heavy duty" or "super heavy duty". These batteries are non-hazardous and can be placed in the trash. (See note below.)

Alkaline batteries are non-rechargeable batteries that can last up to 10 times longer than zinc batteries, but may cost three to five times more. Alkaline batteries sold after May 13, 1996, have no mercury added and may be placed in the regular trash. These may be identified by seeing a green stripe, green tree, "Hg free" label, or an expiration date later than 1998. (Note: older batteries may contain mercury, and should be handled as hazardous or universal waste. See note below.)

Lithium non-rechargeable batteries can last about twice as long as alkaline batteries but are more expensive. Lithium rechargeable batteries are very expensive but extremely light and high in energy density. They are used in some cellular phones and notebook computers. Lithium manganese dioxide and lithium-sulfur dioxide (single-cell) batteries are non-hazardous solid waste. Lithium-sulfur dioxide (multi-cell) may be hazardous waste if it is not discharged completely. Lithium-thionyl chloride batteries are hazardous waste. All batteries that are hazardous waste can be handled as universal waste. If it is not clear whether a battery is hazardous, handle it as universal (or hazardous) waste.

Button cell batteries are small, disc shaped non-rechargeable batteries commonly used in hearing aids, medical devices, watches, calculators and cameras. These batteries contain mercury. They may also contain other hazardous substances, such as silver. They should be handled as hazardous or universal waste.

Nickel-cadmium (Ni-Cd) is the most common type of rechargeable battery. They may be built into rechargeable appliances or sold as freestanding units. A single nickel-cadmium battery can replace about 150 alkaline batteries. They should be handled as hazardous or universal waste.

Sealed lead acids (Pb) are rechargeable batteries used in some camcorders and cellular phones. They are less expensive, but much heavier than other types of rechargeable batteries. Used batteries can be exchanged when purchasing a new one. If exchange is not possible, the battery should be handled as hazardous or universal waste.

Nickel Metal Hydride (Ni-MH) are rechargeable batteries used in phones and camcorders. They have a low drain and high-energy capacity. They should be handled as hazardous or universal waste.

Magnesium, silver, mercury and thermal batteries are also used. These batteries are usually hazardous or universal waste.

Note: Imported items have occasionally contained batteries, normally non-hazardous, with high levels of mercury.

Universal Waste

Waste batteries that are hazardous can be handled as universal waste. These batteries need to be protected from harm. In general, they need to be handled as follows:

- Label the waste batteries as "Universal Waste-Batteries," "Waste Batteries," or "Used Batteries."
- Universal wastes may be accumulated on-site for up to one year.
- Universal wastes may be accepted from off-site and kept for up to one year.
- Properly train employees on proper handling and emergency procedures.
- The batteries can be self-transported or shipped. Department of Transportation regulations will need to be met.
- The batteries should be stored in such a way to protect the waste batteries. Any leaking batteries will have to be handled as hazardous waste. (See the *Hazardous Waste* guide sheet.)
- Ultimately, the batteries need to be recycled.

Recycling

Some hazardous waste haulers also handle universal waste. Contact a hazardous waste hauler to see if they handle batteries. Some companies who handle fluorescent bulbs also handle batteries. There are companies who recycle batteries.

The Rechargeable Battery Recycling Corporation (RBRC) is a non-profit, battery industry-sponsored organization that provides workable plans to collect, transport and recycle used rechargeable batteries. The RBRC recycles the following battery chemistries: nickel cadmium, nickel metal hydride, lithium ion and small sealed lead (weighing less than 2 lbs./1 kg). They can be contacted at 1-877-723-1297 or at their Web site at: www.rbrc.org/index.html.

Contact the Environmental Assistance Office for additional information at 1-800-361-4827.

Remember

- Some batteries are hazardous and need to be handled as hazardous waste or universal waste.
- If it is not clear whether a battery is hazardous, handle it as universal (or hazardous) waste.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people.

- ✓ Rechargeable batteries can be reused repeatedly. Non-rechargeable batteries can only be used once and then thrown away.

For More Information

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Bleach Solution

In processing color film, the bleach bath converts metallic silver on film back to a silver halide. Bleaching uses a number of chemicals, including potassium ferricyanide, potassium bromide, ammonium thiocyanate and acids. The used bleach may be a hazardous waste because of the silver content or pH. See the *Hazardous Waste* guide sheet for more information.

Most facilities find it worthwhile to remove silver from their photo chemical wastes. Approval from the Missouri Department of Natural Resources is not needed to remove silver from photo chemical waste if it is done at the facility. However, if photo chemicals are sent off-site for silver recovery, there are requirements to follow. See the *Silver Recovery* and *Hazardous Waste* guide sheets for more information.

Facilities that use a chemical recovery cartridge to recover silver from wastewater may want to put the bleach solution through this cartridge. Check with the vendor or manufacturer of the silver recovery equipment to find out what solutions the recovery system can handle.

As with other silver-contaminated waste, bleach solution can cause problems if it is put down the drain. Do not put bleach or other photo chemicals down the drain unless it is connected to a sewer and wastewater treatment plant and the plant has given permission to do so. It may be necessary to remove the silver or pretreat the waste in some other way before the wastewater treatment plant can accept it. Never pour solvent or any other waste onto the ground. Doing so can seriously harm the environment and those handling the waste. Also, there are serious penalties for illegally disposing of waste.

If a facility is not connected to a sewer and treatment plant, it will need to collect its waste bleach solution and find out whether it is a hazardous waste. If the waste is hazardous, it must be managed by sending it to a permitted hazardous waste facility or to a facility doing silver recovery. If other photographic chemicals are sent off-site for silver recovery, ask the service company if they will accept the bleach solution. See the *Silver Recovery* and *Hazardous Waste* guide sheets for more information.

If waste bleach solution is determined not to be hazardous waste, it can be hauled to a wastewater treatment plant, if the plant agrees to accept it. Also, if the waste is not hazardous, it may be able to be neutralized on-site.

Remember

- Never put bleach or other photochemicals into a septic system or onto the ground.
- Bleach solution may be a hazardous waste so don't ever put bleach directly down a sanitary sewer drain without permission from the treatment plant. The silver in it may need to be removed or pretreated in some way.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Consider regenerating used bleach solutions. Ask the chemical supplier for more information.
- ✓ Consider using low replenishment options for bleach.
- ✓ Replace ferricyanide bleach with ferric EDTA, which is less hazardous.
- ✓ Regenerate spent ferricyanide bleach by using one of the following methods: ozone oxidation, electrolysis, or use of liquid bromine.
- ✓ Use floating lids or balls on bleach containers to keep it fresh.

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Developer

Waste developer is a significant waste stream from photo processing operations. Exposed film is placed in the developer solution, which changes silver ions on the film into black metallic silver. This creates the film image.

Developers contain organics, acids, alkalis, formaldehyde and alcohols. They can be very irritating to the skin and eyes. Some developers are moderately to highly toxic. Developers and their components can be very corrosive. Developers typically are alkaline, with a pH between 9 and 12. The chemicals, before they are mixed, can have both very high pHs (over 12.5) and very low pHs (less than 2). Both the component chemicals and the used developer may be hazardous waste because of the pH. The used developer may also be hazardous waste because of the amount of silver in the used developer.

Discharge to sewer

Businesses connected to a sewer and wastewater treatment plant should contact the plant to discuss whether developer wastes can be disposed of in the sewer system. The wastewater treatment plant may require some type of pretreatment, such as neutralization and silver recovery. However, because of the high pH and low silver content of the waste developer, silver recovery is often not performed on it. The efficiency of the silver recovery could be reduced if the waste developer is mixed with other photo processing chemicals. The mixture could also result in ammonia generation.

Shops that use very large quantities of photographic chemicals may find it necessary to install package biological treatment systems to reduce the biochemical oxygen demand of the waste developer before disposal.

Facilities not connected to a wastewater treatment plant can get a permit from the Department of Natural Resources to treat the wastewater on-site. Another option would be to collect the wastewater, determine if it is hazardous waste, and manage it properly.

Never put waste developer or any other photo chemical into a septic system or onto the ground.

Hazardous waste

If waste chemicals cannot be discharged to the sanitary sewer, and they have any characteristics of a hazardous waste, they must be disposed of as a hazardous waste. It is important to determine whether waste developer or component chemicals are a regulated hazardous waste. The *Hazardous Waste* guide sheet can help.

Remember

- Provide pretreatment of the waste developer and component chemicals as needed.
- If required, properly handle the waste developer and component chemicals as hazardous waste.
- Make sure that the silver recovery unit can handle developer before trying to recycle the silver from developer.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Squeegees can be used in non-automated (and some automated) processing systems to wipe excess liquid from the film and paper. Squeegees can reduce chemical carryover from one process bath to the next.
- ✓ Technologies for reuse of developer are available and include ozone oxidation, electrolysis, and ion exchange.
- ✓ Use floating lids or balls on developer containers to keep it fresh.
- ✓ Stored process bath chemical should be protected from oxidation by reducing exposure to air.

For More Information

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Energy

Energy conservation can reduce cost and help the environment. Efficiency upgrades can provide significant energy and dollar savings.

The following are a list of reliable, low-risk, high-return simple energy savers:

- 1) **Turn off lights and equipment when they are not in use.** Seems obvious, but high utility costs often include paying for energy that is completely wasted.
- 2) **Install "occupancy sensors" in spaces that are often unoccupied, including some offices, warehouses, storerooms, restrooms, loading docks, corridors and stairwells, office lounges, and conference rooms.** Occupancy sensors detect the presence or absence of people and turn lights on and off accordingly. They may reduce lighting energy consumption by 50 percent or more in some circumstances.
- 3) **Replace incandescent light bulbs with compact fluorescent lamps (CFLs), wherever appropriate.** CFLs cost about 75% less to operate, and last about 10 times longer. (Review the guide sheet *Fluorescent Bulbs* for disposal information.)
- 4) **Replace T-12 fluorescent fixtures with T-8 or T-5 fixtures with electronic ballast.**
- 5) **Install LED (light-emitting diode) exit signs.** The current fixture may accept a simple, "screw-in" lighting element to replace the small incandescent bulbs that burn out with frustrating frequency. This string of LEDs costs about \$15 to \$20, lasts decades, gives brighter light, and ends risky ladder climbing to replace bulbs. If the current exit sign will not accept the screw-in lighting element, a new LED exit sign fixture costs about \$100, and saves about 90 percent over incandescent bulbs' operating costs.
- 6) **Adjust lighting to actual needs by using "task lighting" and "daylighting."** The use of localized task lighting allows for lower ambient lighting levels. When there is adequate daylight electric fixtures can be dimmed or turned off completely. Too much light can be as bad for visual quality as too little light and it adds to the utility costs.
- 7) **Buy ENERGY STAR® labeled office equipment, and other products, when replacing or purchasing new equipment.** Office equipment that has earned the ENERGY STAR helps eliminate wasted energy through special power management features. When equipment is not in use, it automatically enters a low-power "sleep" mode. An ENERGY STAR qualified computer in sleep mode consumes about 80 percent less electricity than it does in full-power mode. Overall, ENERGY STAR qualified office equipment use about half as much electricity as standard equipment.
- 8) **Tune-up the HVAC system with a semi-annual maintenance contract.** Even a new HVAC (heating/ventilation/air-conditioning) system will decline in performance without regular maintenance. The cost for this service varies by local HVAC contractor, but it is likely to save more money than it costs. It automatically ensures "pre-season" system check-ups before each cooling and heating season.
- 9) **Regularly change (or clean if reusable) the HVAC filters.** During peak cooling or heating season, change or clean the filters every month; they cost about \$2-3 each. Dirty filters can cost up to \$5 a month extra, overwork the equipment, and result in dirtier indoor air. Consider

purchasing "electrostatic" filters, which are washable, long lasting, and provide cleaner air. Clean or change filters more often if smokers or pollution sources are present.

- 10) **Install a programmable thermostat for the HVAC system.** An "old-fashioned" thermostat turns the HVAC on and off based on temperature. A solid-state, electronic programmable thermostat can optimize HVAC operation 24/7, based on the business's needs. For example, instead of heating or cooling all night, a "smart thermostat" can turn on a building's HVAC one hour before the first employees arrive.
- 11) **Control direct sun through windows.** During the cooling season, block direct heat gain from the sun shining through glass on the east and west sides of the building. Depending on the situation, there are several options such as "solar screen," "solar film," awnings and vines. Over time, trees can attractively shade the glass and building. Interior curtains or drapes can help, but it is best to prevent the summer heat from getting past the glass and inside. During the heating season, with the sun low in the south, unobstructed southern windows contribute to the building heat during the day, but should be covered at night.
- 12) **Paint ceilings and sidewalks with a white semi-gloss paint.** This will enhance the lighting quality at most work stations by raising the brightness levels and shortening shadows and glare whether light is from electric fixtures or from the sun.
- 13) **Use fans.** Comfort is a function of temperature, humidity and air movement. Moving air can make a somewhat higher temperature and/or humidity feel comfortable. Fans help delay or reduce the need for air-conditioning. They allow the temperature to be raised 3-5 degrees. Each degree of higher temperature saves about 3 percent on cooling costs. In businesses, like restaurants, with high heat and humidity from cooking, fans can make a huge difference in employee and customer comfort.
- 14) **Plug or fill any cracks or air leaks with weather-stripping and caulking.** Look for cracks around windows, doors, utility switches and outlets, and any other gaps between the inside and the outside of the structure.
- 15) **Make sure building maintenance and cleaning staff are enthusiastic about savings and adopt work habits that support energy efficiency.**
- 16) **Assign one person to review and track utility usage and cost.** This person should provide education to all employees on the energy savings efforts at the work place. A good energy savings program will involve all employees and encourage suggestions on energy savings opportunities.

For additional assistance on evaluating ways to reduce utility costs, contact the local utility company, local engineering firms or an energy service company (ESCO). These companies can provide an in-depth energy audit of a facility and identify the most economical energy savings measures to implement. You may also contact the Missouri Energy Center in the Department of Natural Resources at 1-800-361-4827 for additional help.

For additional information see the following web sites.

www.energystar.gov/smallbiz

www.rebuild.org/sectors/commercial/

www.eere.energy.gov

www.aceee.org

For More Information

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Film and Paper

Photographic film waste is usually a negative that displays an image of poor quality. Discarded film may be a test strip or leader. Film also may be thrown out because of processing problems, over or under development, or poor inventory management.

The silver is removed from the film or paper during the photofinishing process. Because of this, processed scrap film and paper is not considered a hazardous waste and can be disposed of with the regular trash.

Unprocessed film or paper has silver on it, however, this form of silver is not usually leachable so the film or paper can still go with the regular trash. Because there is silver in the film and paper, it might be worthwhile to consider recovering it. There are a number of silver recovery companies that will accept solid scrap. Silver removal and recovery can also be done on-site. Some photo labs collect fixer overflow in a container and add unprocessed scrap film or paper as it is generated. Once dissolved in the fixer, the silver can be recovered. This process can increase the amount of silver recovered onsite, but it can be messy and it leaves a coating of leachable fixer on the film or paper. This may cause the film or paper to become hazardous waste. (See the *Silver Recovery* and *Hazardous Waste* guide sheets for more information).

Businesses that operate in-house labs have flexibility for material substitution, such as using non-silver film. This switch should be done with care, non-silver based film does not always retain its image as long as silver based film does.

Until recently, most printing processes required taking pictures and then developing them. Recent developments in computers and digital equipment, such as cameras, have changed this process. The image can be downloaded directly to a personal computer rather than be developed. The images can then be edited before they are printed. Materials, time and waste are reduced from draft to final product.

Installation of electronic imaging and/or laser plate making may be feasible in larger print shops. By editing on a video terminal, the need for photographing and reshooting can be reduced. This alternative is costly. Make sure the payback period is evaluated before making a purchase.

Film can become outdated. Strict inventory control should be implemented to insure first in and first out of material. Proper storage conditions are necessary to maximize the life of paper for color prints. One possibility would be to store paper in a refrigerator, if it will not be used for a few days, and in a freezer for longer storage periods.

Remember

- Unprocessed scrap film and paper does not need to be handled as hazardous waste. It can be thrown in the trash.
- Scrap film and paper that has had the silver removed, may be hazardous waste.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Use the oldest film and paper first.
- ✓ Store paper at a cool temperature.
- ✓ Consider going to non-silver based film.
- ✓ Consider sending the unprocessed film and paper to a silver recycler (or remove the silver on-site).

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Fixer

Fixing sets the image areas and removes the silver halides. Fixing baths contain organic chemicals, silver thiocyanate, ammonium compounds and sulfur compounds. Make sure there is good ventilation to control the level of sulfur dioxide gas. Also, cover the bath when it is not being used to prevent evaporation or release of toxic vapors and gases.

Hazardous waste

The fixer allows silver to dissolve out of the film and paper into the solution. Consequently, used fixer and bleach-fixers contain higher concentrations of silver than other spent chemicals. Because of the high silver levels, used fixer is probably a hazardous waste. See the *Hazardous Wastes* guide sheet for more information.

If the waste is hazardous, you must manage it by sending it to a permitted hazardous waste facility, recovering the silver on-site or sending it to a facility doing silver recovery. If other photographic chemicals are sent off-site for silver recovery, ask the service company if it will accept fixer solution.

Silver Recovery

Most photo processors find it worthwhile to recover silver from the fixer. Options include recovering the silver on-site or sending the silver off-site for management. Approval is not required from the Missouri Department of Natural Resources to remove silver from the facility's own photochemical waste if it is done on-site. However, if photo chemicals are sent off-site for silver recovery, there are requirements to follow. See the *Silver Recovery* and *Hazardous Waste* guide sheets, for more information.

Discharge to sewer

Businesses connected to a wastewater treatment plant should contact the plant to discuss the materials proposed for disposal in the sewer system. The wastewater treatment plant may require some type of pretreatment, such as silver recovery. (See the *Silver Recovery* guide sheet for more information). While the pH of fixers are neutral enough to pour down a drain, individual components or parts of a fixer solution may need to be neutralized before it can be disposed of in the sewer system. Additional pre-treatment may be required.

Facilities not connected to a wastewater treatment plant can get a permit from the department to treat the wastewater on-site. Another option is to collect the wastewater, determine if it is hazardous waste, and then manage it properly.

Never put waste fixer or any other photochemical into a septic system or onto the ground.

Remember

- Don't ever put fixer directly down a sanitary sewer drain without permission from the treatment plant. Silver removal or pretreatment may be necessary.
- If necessary, properly handle the fixer solution as hazardous waste.
- Never put fixer or other photo chemicals into a septic system or onto the ground.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Cover the fixer bath when it is not in use to prevent evaporation or release of toxic vapors and gases.
- ✓ Reuse the fixer. Some technologies available to assist in the reuse of the fixer bath include ozone oxidation, electrolysis, and ion exchange.
- ✓ Squeegees should be regularly checked and replaced to effectively wipe excess liquid from the film and paper.
- ✓ Extend the life of the fixing bath by adding ammonium thiosulfate, which doubles the allowable concentration of silver buildup in the bath.
- ✓ Extend the life of the fixing bath by using an acid stop bath before the fixing bath.
- ✓ Add acetic acid to the fixing bath as needed to keep the pH low.
- ✓ Use low replenishment bleach-fixer to reduce the amount of fresh chemical needed.
- ✓ Use a low-flow wash after the bleach fixer. You can remove silver that could be carried into the wash, where it is more difficult to remove.
- ✓ Spent fixer baths should be segregated from rinse water and developer solution because silver recovery is more efficient in the more concentrated fixer waste stream.

For More Information

Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 526-6627
www.dnr.mo.gov/oac/env_assistance.htm



Floor Cleaning

Floor cleaning at photo processing businesses can have an environmental impact, depending on the cleaning methods used. Floor cleaning is also important from a customer relations' standpoint.

The most important step in preventing environmental problems from floor cleaning is to prevent spills. Use drip pans to catch fluid spills. Place wastes to be disposed of or recycled in proper containers. If there is a fluid spill, clean it up immediately with the appropriate absorbents.

The first cleaning step should be to sweep the floor to remove loose, dry materials. If hazardous materials have fallen on the floor, it is possible that these sweepings could be hazardous waste. For example, developer may contain heavy metals such as silver. If these fluids are mixed with floor sweepings, the sweepings could be contaminated with silver.

Sweepings that are contaminated with hazardous materials will have to be tested. They will require special management and disposal if they are found to be hazardous. See the *Hazardous Waste* guide sheet for more information.

When washing the floor, do not use caustic cleansers or solvents that can cause damage to a public sewer and treatment system or to a private septic system. Biodegradable soaps are available and are usually gentler on both these systems. Be particularly cautious if the shop is not connected to a public sewer system. Some cleaning chemicals and solvents can seriously damage septic systems.

Facilities connected to a public sewer and wastewater treatment system should contact the treatment facility and tell the facility operators about the materials being handled. The treatment facility will determine if it can accept that wastewater. There may also be local regulations restricting what can be poured down the drain and discharged into the sewer system.

Do not discharge wash water to the outdoors. Release of wastewater that goes off the facility's property could be in violation of Missouri's laws.

Avoid hosing off the floor when dry sweeping is possible. Hosing off the floor uses a great deal of water, creates a greater risk of pollution and is not always effective.

Remember

- Properly handle hazardous waste.
- Contact local sewer plants to find out about local requirements for wastewater discharged to them.
- Do not discharge wastewater outdoors.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of waste can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Prevent spills and clean up spills immediately.
- ✓ Pre-clean the floor with a dry broom.
- ✓ Use biodegradable soap and water to do final cleaning.

For More Information

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Fluorescent Bulbs

Many people use fluorescent lights. Fluorescent bulbs contain toxic metals such as mercury, cadmium and lead. Unbroken lamps pose no threat to human health and the environment and may be managed as a universal waste. However, when fluorescent bulbs are broken, people may be exposed to toxic levels of mercury vapor and other metals which can be easily inhaled.

The Missouri Department of Natural Resources encourages prudent lamp recycling to safeguard human health and to limit the amount of toxic heavy metals entering the environment.

Businesses that generate one or two lamps infrequently and are conditionally exempt small quantity generators of hazardous waste, may dispose of these lamps in a Missouri sanitary landfill. Before disposal, place the lamp into the box the replacement lamp came in, put the box into a plastic bag and secure the bag at the top before placing it into the dumpster. These precautions will help keep the bulb from breaking right away and will help protect the employees and the trash hauler. (Note: all small quantity generators and large quantity generators of hazardous waste must handle high-mercury fluorescent lamps as either hazardous or universal waste.)

To better protect the environment, the department encourages sending lamps to a certified recycler.

Nonhazardous Lamps

Fluorescent lamps known to be non-hazardous can be sent to a Missouri sanitary landfill or to a lamp recycler. Permission from the landfill operator should be received before disposal. The landfill operator can refuse to accept the waste. The landfill may require a special waste disposal request before accepting the material.

Lamps Sent for Recycling

Businesses in Missouri may send their **unbroken** lamps to a recycler in Missouri that has resource recovery certification from the department or to an out-of-state recycler. Using a licensed hazardous waste transporter is not necessary in Missouri if unbroken lamps are sent as universal waste for recycling. A hazardous waste manifest or other shipping papers may be used to record and track shipments of unbroken lamps.

Hazardous **unbroken** lamps sent for recycling, need to be handled as universal waste. In general, the following practices should be observed:

- Label containers with the words "Universal Waste-Mercury-Containing Lamp(s)," "Waste Mercury-Containing Lamp(s)," or "Used Mercury-Containing Lamp(s);"
- Do not store waste for more than one year;
- Train employees on proper handling and emergency procedures;
- Ship the bulbs per Department of Transportation requirements.

Facilities intending to send hazardous lamps to an out-of-state recycler should contact the environmental agencies in the states through which the lamps will travel for their state

requirements. Other states may require use of a licensed hazardous waste transporter and a manifest for shipments to a recycler even though Missouri does not.

Hazardous Lamps

Fluorescent bulbs are subject to hazardous waste regulations if:

1. They are broken OR
2. They are identified as hazardous and are sent to a facility for treatment, storage or disposal.
(See the *Hazardous Waste* guide sheet for more information.)

There are two ways to determine if lamps are hazardous.

1. Test the waste. The test for determining the toxicity of fluorescent lamps is the Toxicity Characteristic Leaching Procedure (TCLP). If the level of any metal is at or above the acceptable level, the lamps are "hazardous waste." Acceptable levels are published in the Code of Federal Regulations as follows:
 - Mercury - 0.2 milligrams per liter (mg/l)
 - Cadmium - 1 mg/l
 - Lead - 5 mg/l
2. Apply knowledge of the hazardous characteristic. Data from lamp manufacturers shows that traditional fluorescent lamps are likely to be hazardous waste. To avoid the cost of testing, it can be assumed that lamps are hazardous. However, a disposal firm may require test results before taking lamps.

The amount of waste generated determines what hazardous waste regulations must be met. It may be helpful to know that 350 of the standard four-foot long lamps weigh about 220 pounds. Anyone with more than 220 pounds of hazardous waste in a month or at any one time will be regulated at least as a small quantity generator. See the *Hazardous Waste* guide sheet for more information.

Low-mercury lamps are available. Ask the lamp supplier for information.

Remember

- Fluorescent bulbs may be hazardous waste.
- Unbroken fluorescent bulbs can be sent to a bulb recycler.
- Do not break fluorescent bulbs.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of waste can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Purchase low-mercury bulbs.
- ✓ Protect bulbs from breakage.
- ✓ Recycle bulbs.

For More Information

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Hazardous Waste

Most photo processors generate hazardous waste. Typical hazardous wastes include spent silver-containing solutions, spent wash water, unused out-of-date chemicals, and scrap film and paper. It is very important to find out whether wastes are hazardous and follow the law when managing the wastes.

What is a Hazardous Waste?

A waste is a material that is no longer used and will be discarded. It can be solid, liquid or gas. A waste is hazardous if it has properties that could be dangerous to human health and the environment.

It is the facility's responsibility to find out whether its waste is hazardous. A waste is hazardous if:

- It is listed as a hazardous waste in the federal regulations;
- It exhibits a hazardous characteristic;
- It is a hazardous waste by Missouri law; or
- It is a mixture of a listed hazardous waste and any other waste.

Listed Hazardous Waste

The federal government publishes lists of hazardous wastes. There are four different lists: the F list, the K list, the P list and the U list. Wastes that are on the P list are called "acutely hazardous" and are regulated more strictly than the other types.

Characteristic Hazardous Waste

Some wastes that are not on the lists may still be regulated hazardous wastes because they have characteristics that make them hazardous. There are four characteristics:

- **Ignitable** - A waste with a flashpoint of less than 140° F, or solids that catch fire easily and burn so rapidly they create a hazard. Some solvents are ignitable.
- **Corrosive** - A waste with a pH less than or equal to 2.0 or greater than or equal to 12.5. An example is some photochemical components.
- **Reactive** - Wastes that are normally unstable, react violently with water, can explode or release poisonous gases.
- **Toxic** - Wastes with high concentrations of certain organic chemicals, heavy metals or pesticides when tested by the toxicity characteristic leaching procedure (TCLP). Federal regulations contain a list of toxic chemicals. An example is the silver containing solutions.

Missouri-specific Hazardous Waste

An individual state can regulate wastes as hazardous even if they are not on the federal list.

Mixed Waste

Any time a waste is mixed with another waste that is on the F, P, K or U list, all of it is hazardous, even if there is only a very small amount of listed hazardous waste in the mixture. For example, if a cup of waste toluene is poured in with 55 gallons of water, the result is a little more than 55 gallons of hazardous waste.

Is This Waste Hazardous?

To find out if waste is hazardous, check to see if it is on the lists of hazardous wastes (federal or state). If it is not, find out if it exhibits one or more of the hazardous characteristics. Check the material safety data sheet (MSDS) or contact the supplier for information. The manufacturer of the film, paper or photo

chemicals may be able to tell you whether the used material is hazardous waste. If the information is not available another way, the waste will need to be tested.

If there is uncertainty about whether a waste is hazardous, it will need to be tested in a laboratory. The test for toxics is called the toxicity characteristic leaching procedure (TCLP). Test only for items that may be in the waste, i.e. test for silver in developer not lead, tests for ignitability and corrosivity may also be needed. Many laboratories can do these tests. Check the phone directory or ask a trade association for suggestions. Contact the Department of Natural Resources at 1-800-361-4827 for help with this.

Managing Hazardous Wastes

There are very specific requirements for managing hazardous waste from a business. The requirements that must be met depend on what and how much waste the business generates. Business owners need to know how much acutely hazardous waste (P-listed) and non-acute hazardous waste the business generates each month. They also need to know how much of each of these types of waste is accumulated at any one time.

Use the following information to determine your generator status. See the *Hazardous Waste Management* guide sheet for more information on how to label, store and dispose of your hazardous waste.

What Type of Generator Are You?

There are three types of hazardous waste generators: large quantity generator (LQG), small quantity generator (SQG) and conditionally exempt small quantity generator (CESQG). Here are some general guidelines to help you decide what type of generator you are:

Those who generate in one month or accumulate at any one time . . .

- More than 1 kg (2.2 pounds) of acutely hazardous waste are an LQG.
- 1,000 kg (2,200 pounds) or more of non-acute hazardous waste are an LQG.
- More than 100 kg (about 220 pounds), but less than 1,000 kg (2,200 pounds) of non-acute hazardous waste AND less than 1 kg of acutely hazardous waste are an SQG.
- No more than 100 kg (220 pounds) of non-acute hazardous waste AND less than 1 kg of acutely hazardous waste are a CESQG.
- In Missouri, anyone generating one gram or more of dioxin waste (2,3,7,8-tetrachlorodibenzo-p-dioxin) is an LQG.

All SQGs or LQGs must register with the department and get a generator identification number. They also must follow regulations on storage, transport, record-keeping and reporting. Call the department for more information.

Note: The federal requirements for hazardous waste can be found in the *Code of Federal Regulations*, Title 40, Part 260 through Part 280 (40 CFR 260-280). The Missouri Hazardous Waste Law is in the *Revised Statutes of Missouri* (RSMo), Sections 260.350-260.552. The hazardous waste rules are in the *Code of State Regulations*, Title 10, Division 25 (10 CSR 25). To get information on the regulations, call the Missouri Department of Natural Resources at 1-800-361-4827.

Remember

- Facility owners/operators are responsible for determining if waste is hazardous.
- SQGs and LQGs need to register.

For More Information

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Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 526-6627
www.dnr.mo.gov/oac/env_assistance.htm



Hazardous Waste Management

Most photo processors generate hazardous waste, and there are requirements for how that waste is managed. The amount of waste generated determines on what rules must be followed. This guide describes the main requirements. For information on how to decide if waste is hazardous, see the *Hazardous Waste* guide sheet. This list does not include every requirement for every generator. It is general guidance for large quantity generators (LQG) and small quantity generators (SQG).

Containers

- Hazardous waste containers must be in good condition. If a container leaks, transfer waste to a new container.
- Do not let rainwater accumulate on top of the container.
- Keep containers closed and use self-closing funnels when adding waste.
- Use containers that are compatible with the waste. For example, use HDPE (high-density polyethylene) plastic containers for corrosive wastes.
- Never place incompatible wastes, such as wastes that react with each other (acids and bases) in the same container. Keep silver-containing hazardous waste separate from the rest of your hazardous waste if you are doing silver recovery.

Storage

- Keep aisle space between container rows to allow inspection for leaks and damage.
- Store ignitable and reactive wastes at least 50 feet from property boundaries.
- Store containers of incompatible wastes in separate areas.
- There are limits on how long waste can be stored. (From 90 days to 270 days according to the generator status.)

Labels

- Label every container with the type of waste and whether it is hazardous or non-hazardous.
- Include EPA hazardous waste numbers or Missouri waste code numbers.
- Include the date waste was first placed in the container. When the container is moved to storage, change the date to the first storage date.
- Include your business's name and address.
- Use the following words on labels for hazardous wastes:

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

If found, please contact the nearest police or public safety authority or the U.S. EPA
(The business's name and address and manifest document number)

Transport and Disposal

- Make sure the hazardous waste transporter has an EPA identification number and a Missouri hazardous waste transporter license.
- Make sure the place receiving the waste has EPA identification numbers and state permits.
- Use manifests for hazardous wastes shipped off-site.

Inspections and Record Keeping

- Inspect containers at least once a week and keep a written log of inspections.
- Keep training and inspection records, manifests, shipping receipts and records of lab tests for three years.
- Keep land disposal restriction forms for five years. This form defines whether the waste can be land disposed.

Training

- Train all employees to identify, reduce and properly handle wastes.
- Train new employees before they handle hazardous waste.

Notify Department of Natural Resources

- Small and large quantity generators must register as generators with the department to get an EPA and Missouri generator identification number.

Emergency Preparedness

- Notify police departments, fire departments and local hospitals. They need to know what hazardous wastes are on-site.
- Designate an emergency coordinator. This person must know what to do in case of a fire, spill or other emergency and must be on the premises or on call 24 hours a day.

Contingency Plans

Large quantity generators must have a written plan for handling emergencies that includes the following. A written plan is a good idea even for those who are not large quantity generators..

- Response arrangements with police, fire departments, hospitals and emergency response contractors.
- Emergency coordinator's address and phone number(s).
- On-site emergency equipment descriptions and locations.
- Evacuation plan and routes, including a site diagram.

Post Emergency Information

Post the following information near every telephone:

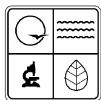
- Fire department phone number.
- Emergency coordinator's name and phone number.
- Fire alarm and extinguisher locations.
- Locations of spill control materials.

Remember

- Determine whether the waste is hazardous and manage it correctly.
- Find ways to eliminate or reduce hazardous wastes. This will reduce the number of requirements that must be met. See the pollution prevention suggestions on other guide sheets, particularly those dealing with silver containing wastes and hazardous components.

For More Information

Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 526-6627
www.dnr.mo.gov/oac/env_assistance.htm



Plastic Film Containers

Photo processors often have a surplus of plastic containers that held film. Most plastic film containers are made of either polyethylene or polystyrene. Both are recyclable. Some film manufacturers accept containers for recycling. You may have to pay the shipping cost, but you will avoid the cost of disposal.

If you aren't able to recycle the plastic film containers, they may be put in the trash. Single use cameras can be returned to the manufacturer for recycling.

Film is usually received in rolls, cassettes, cartridges or canisters. These containers are often recyclable. A distributor of microfilm catalogs reuses the plastic housing returned by its customers up to six or seven times.

Kodak Environmental Services
1100 Ridgeway Ave.
Rochester, NY 14652-6255
1-800-242-2424
www.kodak.com/go/kes

Another company that accepts plastic film waste is:
Plastic Innovations, Inc.
906 Lane Ave.
Crawfordsville, IN 47933
1-800-777-7644
www.plastic-innovations.com

Photo processors may also receive process chemicals in 55-gallon barrels, 5-gallon pails or small plastic bottles. Many of these containers are also made of recyclable plastics and should be recycled whenever possible. Some of these containers may be able to be returned to the supplier for re-use.

Film cartridges and spools are also sometimes made of recyclable plastics. These components should be combined with similar plastics for recycling. See Kodak's or Plastic Innovations' Web sites or call them for details.

Plastic recyclers for larger plastic containers can also be found on the Internet or in your local yellow pages.

Remember

- Plastic film containers are not a hazardous waste so if you cannot recycle them, they can be disposed of with your regular trash.
- Plastic chemical containers should be recycled or shipped back to suppliers whenever possible.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Use Kodak's or Plastic Innovations, Inc. plastic film container recycling programs.
- ✓ Offer the containers to customers for reuse.

For More Information

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Shop Towels

Discarded shop towels or rags-either cloth or paper-may be contaminated with hazardous wastes. If they are, the towels or rags may be hazardous waste.

Listed hazardous wastes include solvents such as methyl ethyl ketone, toluene, and xylene. A waste can also be hazardous if it is toxic, ignitable, reactive or corrosive. This type of waste is called a characteristic hazardous waste. See *Hazardous Waste* guide sheet for more information on what wastes are hazardous.

Any waste that is mixed with a listed hazardous waste becomes a hazardous waste. Towels with a listed hazardous waste on them become hazardous waste themselves when discarded. The towels could also be characteristic hazardous waste, particularly if they are contaminated with metals like silver or chromium, or if they can burst into flames.

The best way to deal with listed or ignitable hazardous waste is to prevent the problem. If you use non-hazardous cleaning solvents, the solvent will not cause the towel to become hazardous.

If used towels or rags are laundered and reused, they are not regulated as a solid waste or as a hazardous waste. You should tell your laundry what kind of chemicals are on the shop towels and make sure they can handle that type of material.

If you wash your own shop towels, be sure to check with your wastewater treatment plant to find out whether they can accept the wastewater discharge you are putting down the drain. You may need to pretreat your wastewater. Do not launder contaminated shop towels if the wastewater does not go to a treatment plant.

Do not launder towels or rags used to clean up spills of hazardous waste. If you use shop towels to clean up spills of listed hazardous waste, the shop towels are hazardous waste and must be disposed of at a permitted hazardous waste treatment, storage or disposal facility.

If you plan to throw away dirty shop towels or rags, you need to find out whether they are hazardous waste. If the shop towels are hazardous, you must comply with the regulations for management, storage, transport and disposal of hazardous waste.

If your used towels are non-hazardous, you may send them to a sanitary landfill. Landfills cannot accept liquids, so be sure to collect and use any liquid from your shop towels.

Remember that oily or solvent-soaked towels can catch fire easily. Store them safely. Some people spray the rags with water to prevent fires.

Remember

- Shop towels used to clean up spills of listed hazardous waste must be managed as hazardous waste.
- Shop towels contaminated with listed hazardous waste are hazardous waste.
- If dirty shop towels are laundered and reused, they are not waste. Let the laundry know what type of solvents or other materials are on the dirty towels.
- Do not wash your dirty shop towels unless the wastewater goes to a wastewater treatment plant. Check with staff at the treatment plant to be sure it can handle the wastewater.
- If you are throwing away contaminated shop towels, you must find out whether they are hazardous waste and follow the regulations that apply. See guide sheet on *Hazardous Waste*.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of waste can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Use non-hazardous cleaners and solvents.
- ✓ Do not use shop towels to clean up spills of hazardous materials. Use drip pans to prevent spills and appropriate absorbents for cleanup.
- ✓ Use the least amount of solvent needed.
- ✓ Collect and recycle solvents from contaminated shop towels. You can use a wringer to remove the liquid or simply allow the towels to drain over a container. Reuse solvents if possible.

For More Information

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Silver Recovery

Used photo chemicals usually contain significant amounts of silver. Film and photographic paper may also contain silver. Silver is a valuable metal but it is also a pollutant. Some forms of silver can harm people and the environment if not properly managed. For these reasons, silver should be recovered and recycled from waste photochemicals.

Such waste can be shipped off-site or kept on-site for silver recovery. The decision should be based on the volume of waste, cost of off-site service, cost of on-site equipment, and the facility's ability to operate and maintain silver recovery equipment. No matter how the silver is recovered, the "silver" hazardous waste must be kept separate from the rest of your hazardous waste.

Evaluating your waste

Whether you do your silver recovery on-site or send it somewhere for reclamation, you will need to evaluate the silver-containing items before they are shipped off-site. You will need to decide if the silver-containing item is product, waste or hazardous waste. Your silver recovery vendor can help you make this determination. Call the Environmental Assistance Office at 1-800-361-4827 for help with making the determination.

- Product - if the item can be used without additional processing.
- Hazardous waste - if the item requires additional processing and it fails a toxicity characteristic leaching procedure (TCLP) test.
- Non-hazardous waste – Non-hazardous per the TCLP test and not a product.

Shipping off-site

If your silver-bearing wastes are regulated hazardous wastes and you send them off-site for silver recovery, you need to learn how much total hazardous waste you generate. If you generate more than 220 pounds of hazardous waste per month or at any one time, you are classified as a small or large quantity hazardous waste generator (SQG or LQG).

For silver-containing hazardous waste a LQG or SQG must:

- Fill out a uniform hazardous waste manifest and send it with your waste when it is sent off-site.
- Report to the department the amount and types of wastes you generate each year.
- Use hazardous waste transporters.

If you have questions about whether the facility can legally accept your waste or you need copies of forms, call the Environmental Assistance Office at 1-800-361-4827.

On-site recovery

You do not need a permit from the department to recover silver from your own photo chemicals or wastewater on-site; however, you do need to notify the department of your recycling activities. You need to track how much waste is being recycled. This is done by looking at how much waste you have at the beginning of the year and the end of the year. Also how much waste is generated during the year. Send the information to the hazardous waste program at the address at the bottom of this page.

Types of On-Site Silver Recovery

| Method | Advantages | Disadvantages |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Metallic Replacement</i> – The dissolved silver reacts with the solid metal, usually iron. The silver goes to the solid metal and the solid metal goes into the solution | ➤ Low investment ➤ Low operating cost ➤ Simplest operation | ➤ High iron content of effluent ➤ Silver recovered as sludge ➤ High silver concentration in effluent unless two units are in series |
| <i>Electrolytic Recovery</i> – The unit can be used for a primary or a tailing waste stream, and can be either batch or continuous. A direct current is applied across two electrodes in a silver-bearing solution. Metallic silver deposits on the cathode. | ➤ Recovers silver as pure metal ➤ High silver recovery ➤ Silver is probably pure enough it can be handled as product, not hazardous waste. | ➤ Potential for sulfide formation ➤ High silver concentration in effluent |
| <i>Precipitation</i> – Chemical precipitation is widely used by manufacturers of photographic supplies, but because of its complexity and inherent danger, it is usually not done by photo processors. | ➤ Can reduce silver concentrations to very low level – 0.1 mg Ag/L ➤ Low investment | ➤ Complex operation ➤ Silver recovered as sludge ➤ Treated solution cannot be reused ➤ Potential hydrogen sulfide gas release |
| <i>Reverse Osmosis</i> – (Normally for rinse water) The waste water stream flows under pressure through a membrane. Water molecules pass through the membrane and other constituents are left behind. | ➤ Also recovers other chemicals ➤ Purified water is recyclable | ➤ Concentrate requires further processing ➤ High investment ➤ High operating cost |
| <i>Ion Exchange</i> – (Normally for rinse water) This is the reversible exchange of ions between a solid resin and a liquid. | ➤ Can reduce silver concentrations to very low level – 0.1 – 2.0 mg Ag/L | ➤ Only for dilute wastewater ➤ Complex operation ➤ High investment |
| <i>Evaporation</i> – Wastewater is collected and heated to evaporate all liquids. The resulting sludge is collected in filter bags and sent to a silver reclaimer. | ➤ Minimum wastewater discharge ➤ Water conservation - Can accommodate operations that do not have access to sewer connections or waste water discharge | ➤ High energy requirement ➤ Silver recovered as a sludge ➤ Organic contaminant buildup ➤ Potential air emissions |

Remember

- Determine if silver-containing waste is hazardous waste. Handle the waste properly.
- Determine how much waste is recycled in a year.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Convert to film that does not contain silver.
- ✓ Use digital cameras.

For More Information

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www.dnr.mo.gov/oac/env_assistance.htm

Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176
Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 751-3176
www.dnr.mo.gov/alpd/hwp/index.html



Solvents

You can help protect the environment, protect workers in your shop and save money by reducing the amount of solvent you use, by reusing or recycling your solvent, and by using the least hazardous solvent that will do the job. See these guide sheets for more information on hazardous waste and solvent disposal:

Hazardous Waste

Hazardous Waste Management

Solvent Disposal

Air Pollution From Solvents

Many solvents contain volatile organic compounds (VOCs). These are chemicals that get into the air and can harm people and the environment. The material safety data sheet (MSDS) will have information on the amount of VOCs in the products you buy. Always try to use the material with the lowest percentage of VOCs possible. Missouri has rules to protect air quality. The types of rules that apply to your shop depend on the type and quantity of materials you use, as well as the size of your operation.

Reducing Solvent Waste

Solvents can be expensive to purchase and to dispose. It makes good sense to try to reduce the amount of solvent you use. Often, solvent can be reused, which means you can purchase less new solvent. Reducing the amount of solvent used saves money and protects the environment.

Here are some ideas for reducing solvent use:

- Keep solvent containers closed. Any solvent that evaporates at your shop is solvent you paid for and can't use. Some people estimate that as much as 40 percent of solvents are lost due to evaporation, equipment leaks, spills, or inappropriate use.
- Set up and follow a maintenance schedule for equipment. This can prevent leaks.
- Check regularly for leaks, drips and spills. Repair leaks and clean up spills right away.
- Schedule jobs in a way that reduces the need to clean between jobs.
- Keep solvent containers closed. This is so important that the list begins and ends with it.

Remember

- Solvent can be hazardous waste.
- Use the least hazardous solvent that will do the job.
- Ask the supplier if non-hazardous solvents are available.
- Solvent that evaporates is solvent paid for but not used. Keep containers tightly closed and in good condition.
- Use the solvent with the lowest VOC content possible.

For More Information

Missouri Department of Natural Resources
Environmental Assistance Office
P.O. Box 176
Jefferson City, MO 65102-0176
1-800-361-4827 or (573) 526-6627
www.dnr.mo.gov/oac/env_assistance.htm



Solvent Disposal

Solvent is expensive to buy and to discard. It makes sense to try to reduce the amount of solvent used and, if possible, reuse solvent. See the *Solvents* guide sheet for more information about recycling and reuse.

Many waste solvents are hazardous wastes. Managing hazardous wastes according to the regulations is very important. The *Hazardous Waste* and *Hazardous Waste Management* guide sheets have more information.

To properly manage waste solvent:

- Find out whether the waste is hazardous.
- Figure out how much hazardous waste you generate.
- Learn what rules apply to you based on how much waste you generate.
- Use the services of a waste transporter and disposal or recycling company legally able to take your waste.

Is Your Waste Hazardous?

The EPA maintains a list of wastes regulated as hazardous. Some common listed hazardous waste solvents include; 1,1,1-trichloroethane, trichloroethylene, xylene, acetone, methyl ethyl ketone (MEK), and toluene.

Some solvents are characteristic hazardous wastes, which means they are ignitable, toxic, reactive or corrosive. If the waste has a flash point of less than 140° F, it is an ignitable hazardous waste. The flash point is the temperature at which the solvent will catch on fire. Corrosive hazardous waste has a pH of 2 or less or a pH of 12.5 or higher. Mineral spirits is a solvent with a flash point less than 140° F.

Your solvent supplier should be able to tell you if your solvent is a hazardous waste, or you can check with the manufacturer. If you cannot find out from these sources, contact the Missouri Department of Natural Resources or another environmental professional for help. You will need the material safety data sheet (MSDS).

Even if the solvent itself is not a hazardous waste, the silver or other contaminants in it may cause the used solvent to be a hazardous waste. If any contaminant in your used solvent is hazardous, your used solvent may be hazardous waste. Contact the department for more information on this.

If your waste solvent is a listed hazardous waste, anything it is mixed with becomes hazardous waste. For example, if you use listed solvent on your shop towels, the towels become hazardous waste when discarded.

Managing the Waste

You need to keep track of how much hazardous waste you generate. The rules you must follow depend on how much waste you generate. To learn more about this, see the *Hazardous Waste* guide sheet.

Always keep good records about your waste – how much and what you generate, who transports it and where it goes. In most cases, you will need to get a generator identification number from the department and use a manifest when you ship the waste off-site. The company that transports your hazardous waste must have a Missouri Hazardous Waste Transporter License.

Be sure your waste is going to a place that is legally allowed to take it. For a list of hazardous waste facilities in Missouri, contact the department at 1-800-361-4827.

For more information on managing your hazardous waste solvent, see the *Hazardous Waste Management* guide sheet.

If your waste solvent is not a hazardous waste, check the MSDS for recommended disposal methods. Do not put liquids in your trash. Landfills in Missouri cannot accept liquid waste.

If the drains at your shop lead to a public sewer and wastewater treatment plant, you may be able to pour water-based solvents down the drain. Contact the wastewater plant to ask if they can accept the water-based solvent. **Do not** put solvent or other chemicals down the drain unless the wastewater plant has approved. **Do not** put solvent or any industrial waste down your drain if the drain does not lead to a public wastewater treatment plant. See the *Wastewater* guide sheet for more information. (Note: Some solvent is capable of damaging your plumbing!)

Never pour solvent or any other waste onto the ground. Doing so can seriously harm the environment and you. Also, there are serious penalties for illegally disposing of waste.

Remember

- Find out whether your waste solvent is a hazardous waste. Ask your supplier for non-hazardous solvents.
- Be sure anyone who takes your waste is legally able to do so.
- Never pour any chemicals down the drain unless you have permission from the wastewater plant, and never pour any waste onto the ground.

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Spills

Spills can hurt you and your employees. They can also cause environmental damage at your facility. Facilities of all sizes should maintain all processing tanks and holding tanks for storing silver-rich solutions in a way that prevents accidental release. Spilled materials can pollute soils, ground water, surface waters and wetlands, affect air quality and harm people and wildlife. They can also cause problems at the wastewater treatment plants.

Effluents discharged through normal operations are *not* considered spills. These include:

- Replenisher overflows generated by processing.
- Solution replacement recommended by the chemical manufacturer.
- Solution generated during tank and rack cleaning.
- Rinse water from chemical containers.

A spill is an unplanned discharge of liquid waste of a significant volume into the sewer or the environment. These include:

- A dropped container of a chemical.
- Leaks.
- Overfilling a tank.
- A rupture of a replenisher tank.

Spills that typically are of the greatest concern include spills of concentrates used to prepare working-strength replenishers and spills of silver-rich solutions before silver recovery.

In general, spills of working-strength processing solutions are not emergency situations, because they consist mainly of water and have a relatively neutral pH. However, some chemical concentrates may be very acidic ($\text{pH} < 2$) or basic ($\text{pH} > 12.5$). Some chemicals used for pH adjustment in silver recovery and cleaning operation could be very acidic or basic.

Discharges to a sanitary sewer with a pH of less than 5 are prohibited by federal regulation. Silver-rich solutions can be hazardous waste and have a very negative effect on wastewater treatment. Check with your wastewater treatment plant to find out when you should notify them of a spill and what their spill reporting requirements are. Contact National Emergency Response at 1-800-424-8802 and the Missouri Department of Natural Resources at (573) 634-2436 if you spill more than one pound of silver into the environment or if the spill gets into any waterway.

You need to decide what you will do if there is a spill. We suggest you do the following:

- Develop and maintain a floor plan to identify all areas where a spill or discharge could occur.
- Determine the supplies and equipment required to clean up a spill and where you will store them.

- Develop procedures for using the supplies and equipment.
- Train your employees in how to respond to a spill. Post the spill response instructions.
- Maintain a log of spills to identify trends and help eliminate the causes.

Remember

- Prepare for spills.
- Cleanup spills.
- Report spills as needed.
- Find the cause of spills and correct the problem.

Pollution Prevention Options

Preventing pollution instead of treating or disposing of it can save money, protect the environment and reduce risk to people.

- ✓ Use good work practices to prevent spills.
- ✓ Determine the best way to handle a spill, minimizing the amount of waste generated.
- ✓ Identify where floor drains discharge.
- ✓ Plug floor drains connected to the storm or sanitary sewer if they are located in an area subject to spills of hazardous chemical. If necessary install a sump that is pumped regularly.

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Storm Water Permits – Land Disturbance

Construction Projects

Rainwater and melting snow or ice can easily become polluted if it comes in contact with contaminants. If not properly managed, contaminated water can harm the environment, pollute creeks and lakes, or even contaminate drinking water.

Soil sediment that erodes from a construction activity is a large contributor to water pollution. Storm water not only carries soil particles, a major pollutant; but can also carry attached pollutants such as petroleum products, metals, chemicals, pesticides, nutrients and bacteria.

If your construction project will include the removal of vegetation, grading or excavating in an area one acre or larger, you are required to obtain a storm water land disturbance permit. Land disturbance permits require the use of “Best Management Practices” (BMPs) to minimize soil erosion from the site. BMPs include maintaining vegetation, temporary re-vegetation, silt fences, straw bales and sediment basins.

Resources:

Refer to the technical bulletin “Storm Water Permit Requirements for Land Disturbance Activities” that can be viewed at www.dnr.mo.gov/oac/pub2009.pdf.

Remember

- If you disturb one or more acres of land during your construction project, you must have a Missouri Storm Water Land Disturbance Permit for your storm water discharge.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Your storm water land disturbance permit will require you to develop a Storm Water Pollution Prevention Plan (SWPPP). Include some of the following BMPs in your SWPPP:

- ✓ Preserve existing vegetation where possible.
- ✓ Re-vegetate disturbed areas as soon as possible.
- ✓ Use vegetation buffer strips along water courses.
- ✓ Use interceptor dikes, swales or berms to direct storm water away from storage areas and areas that are prone to erosion.
- ✓ Provide for proper disposal of solid wastes at the construction site.
- ✓ Store construction material away from drainage courses.

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Wastewater

Photo processing businesses generate wastewater during daily operations. This wastewater may contain silver and other contaminants that can create “interference” with the wastewater treatment process at the wastewater treatment plant.

Communities that provide sewer collection and wastewater treatment service may have pretreatment requirements for your wastewater discharge. Pre-treatment is the reduction, elimination, or alteration of pollutants before discharge to a publicly owned wastewater system. Many communities restrict the quantity of silver that may be discharged to a drain. If your business is connected to public sewers, contact the utility to determine discharge limits and prohibitions.

If public sewers and wastewater treatment are not available, you must carefully manage your shop’s wastewater. You must manage hazardous wastewater by sending it to a permitted hazardous waste facility. See the *Hazardous Wastes* guide sheet for more information.

Photo processing wastewater is “industrial wastewater” and **cannot** be discharged to an on-site wastewater system regulated by the Missouri Department of Health and Senior Services (e.g. septic tank and drain field).

You may discharge only your “domestic wastewater” (water from restrooms or kitchen facilities) to a septic system.

Industrial wastewater **can** be treated on-site in a wastewater treatment plant permitted by the Missouri Department of Natural Resources. Another option is to collect your industrial wastewater and send it off-site to a department-permitted wastewater treatment facility.

Do not send industrial wastewater to a septic system, doing so could contaminate the groundwater.

Good waste management practices that reduce, reuse and recycle wastewater can greatly reduce your disposal costs. They will also help protect sewer systems and treatment plants. These waste management practices are called pollution prevention. Pollution prevention options for photo processing include management practices, equipment modifications and process modifications.

Remember

- Treat your “industrial wastewater” at a wastewater treatment plant that is permitted by the Missouri Department of Natural Resources.
- If your business is served by a public wastewater utility, contact the utility to determine your wastewater discharge limits and prohibitions. You may need to pretreat your wastewater before it goes to the treatment facility.

- Do not send “industrial wastewater” to a septic system.
- Do not dispose of wastewater into storm drains, onto the ground or into a body of water.

Pollution Prevention Options

Preventing pollution can save money, protect the environment and reduce risk to people. Here are some suggestions:

- ✓ Recover silver from silver-rich solutions prior to discharge or disposal. Silver is a non-renewable resource, silver has economic value, and public wastewater utilities restrict the amount of silver that can be discharged.
- ✓ Implement management practices that include preventive maintenance, process control, inventory control, spill response planning, good housekeeping, and safety and security measures.
- ✓ Consider possible equipment modifications such as adding squeegees on processors, implementing in-line silver recovery, and equipping processors with counter-current wash tanks or low-flow wash tanks.
- ✓ Consider possible process modifications including using “low replenishment chemicals”, reusing and regenerating photo-processing solutions, converting to a wash-less process, and using dry packaged chemicals and automated mixing to extend chemical shelf life.

Resources:

“Code of Management Practice – Guide for Photo Processors: Recommendations on Technology, Equipment and Management Practices for Controlling Silver Discharges from Facilities that Process Photographic Materials” by the Silver Council.

Web site: www.silverbureau.org/codes/Photo_Manual.pdf

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Water Conservation

Water conservation can reduce cost and help the environment. Water conservation can help to conserve energy if you heat any portion of the water.

Water can be conserved in four general ways.

1. Maintain Water-Supply Equipment

Check pipes, valves, hoses and faucets for leaks. A small leak occurring over an extended period results in a large water loss. Often, comparatively little effort and expense are required to fix the problem, especially if it is caused by a leaky joint or a worn faucet washer.

2. Eliminate Non-process, Non-functional Water Usage

Many photo processing facilities turn the machine wash water on at the start of the workday and leave it on for the entire day. You can save a considerable amount of water by turning the wash water on only during periods of actual processing. You may be able to install an electric solenoid valve to turn on the wash water only when the machine drive is on so that wash water flows only when film or paper is being processed.

3. Use Recommended Wash Rates

Wash rates are carefully calculated to provide adequate washing with a sufficient safety margin to remove chemicals from the emulsion. Using higher wash-water rates is unnecessary and wasteful. Once you set the water flow to the recommended level, be sure to monitor it regularly.

4. Use Techniques that Increase Wash-Water Efficiency

Two techniques that make more efficient use of wash water are countercurrent washes and batch washes. Of the two, countercurrent washing is the most commonly used.

Because countercurrent washing requires at least two tanks and a longer wash time, you cannot use it in all processors. In a countercurrent wash system, fresh water is supplied only to the last tank and used water from this tank is allowed to overflow to the preceding tank. Each succeeding tank has a lower concentration of residual chemicals. Washing is efficient and uses considerably less water.

In a batch-wash system, the film or paper is washed in batches of fresh water. There is no constant flow of fresh water. When washing is complete, the used batch of wash water is dumped and replaced with fresh water for the next processing run. Batch washing is used primarily with manual processes and some small automatic processors. It is not practical for large machines that process continuous strands of film or paper. Like countercurrent washes, it has the advantage of saving a considerable amount of water and energy.

5. Heat Exchangers

Increasing energy costs have created much interest in heat exchangers because they can produce significant energy cost-savings.

Wash-water usage is relatively high in photo processing labs. A large laboratory uses as much as 100,000 gallons of water per week. A heat exchanger uses heat from the wastewater that is normally lost to preheat incoming fresh water.

Two basic types of heat exchangers are used in photographic processing: the plate-and-frame type and the shell-and-tube type.

The plate-and-frame type offers the following advantages:

- greater efficiency at lower temperatures
- less floor space required
- easy cleaning
- high turbulence of solutions to minimize fouling
- easy addition or removal of plates to accommodate need

Whether a heat exchanger is suitable for a laboratory depends on factors, such as:

- temperature of the incoming water
- wash-water reuse
- efficiency of the present heating system
- capital and operating costs of the system

Generally, you can justify installing a heat exchanger in average to large photo processing labs if the incoming water temperature is less than 73°F (23°C).

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UPDATE SERVICE FOR PHOTOPROCESSING GUIDE

Please complete this form and send it to the address below to receive FREE UPDATES to "Preventing Pollution in Photoprocessing." You will receive new and revised pages as they are developed. Please print clearly or type.

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Mail to: Missouri Department of Natural Resources
Environmental Assistance Office
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Jefferson City MO 65102-0176

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